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(58) Field of search
UK CL (Edition K) G2J JB7G JHU, G5C CAC CAD CCD CCF CCG CEN CEP CET CFF
INT CL[5] G02B, G05F

(54) Vehicle display unit

(57) The present invention provides an indication display unit for vehicles which comprises an indicating means 1 for displaying vehicle operational information and a prism 2 having at least three faces mounted on the dashboard in such a manner that a crest portion between first and second adjacent faces 12A, 12B is directed upwards, the first and second faces being directed respectively toward the driver's seat and to the windshield 3, and the third face being firmly attached either to the dash board or to the housing such that the indication surface of the indicating means is directed upwards. An indicated image projected from the indicating means enters the prism by way of the third face thereof, and is reflected on the inner surface of the second face so as finally to be visibly observed by a driver through the first face. The prism may have curved, e.g. convex, first and second faces. Also the prism may be fixed in position as shown in Figure 2, or may be rotatable from position in which the indication of the indicating means can be seen to a position in which it cannot be seen, as shown in Figures 4A and 4B.

FIG. 2

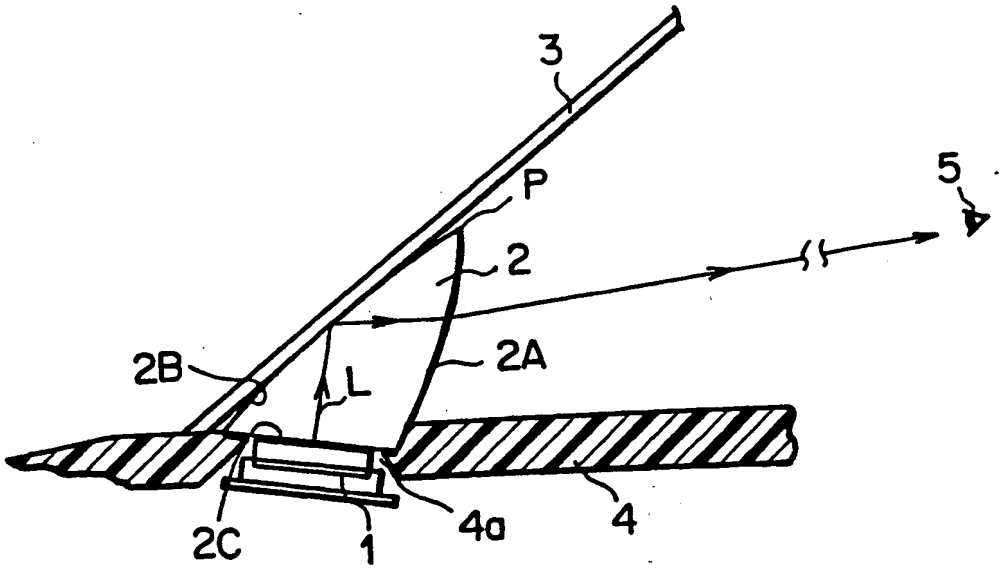

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FIG. 1

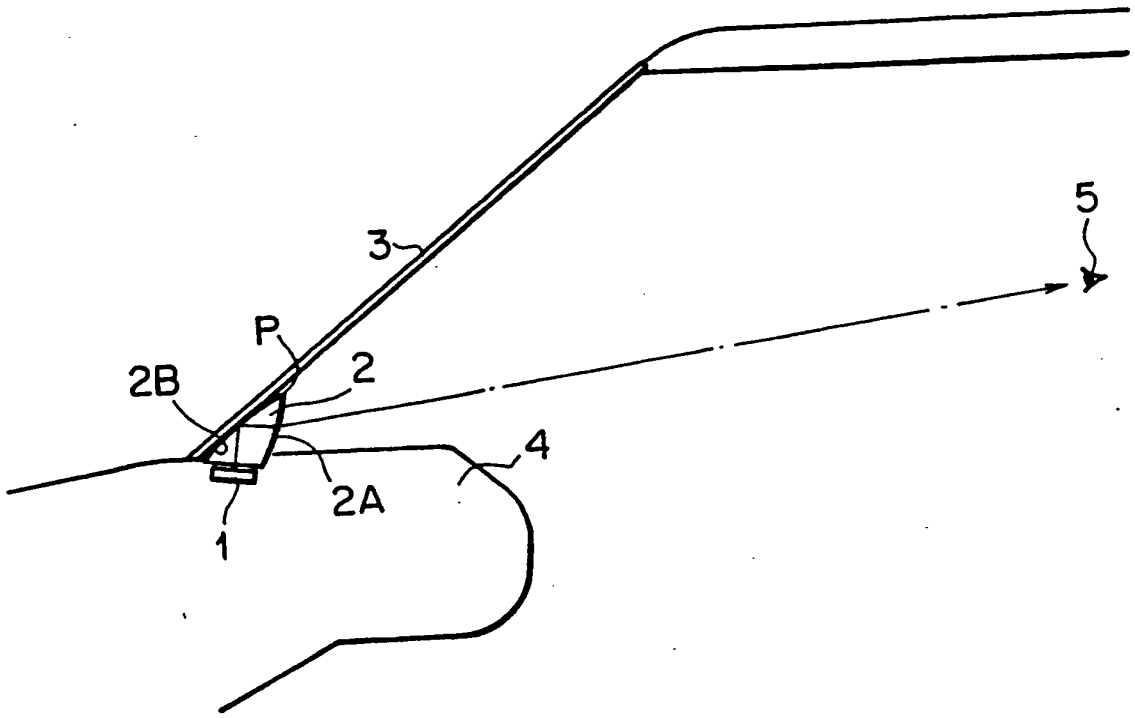


FIG. 2

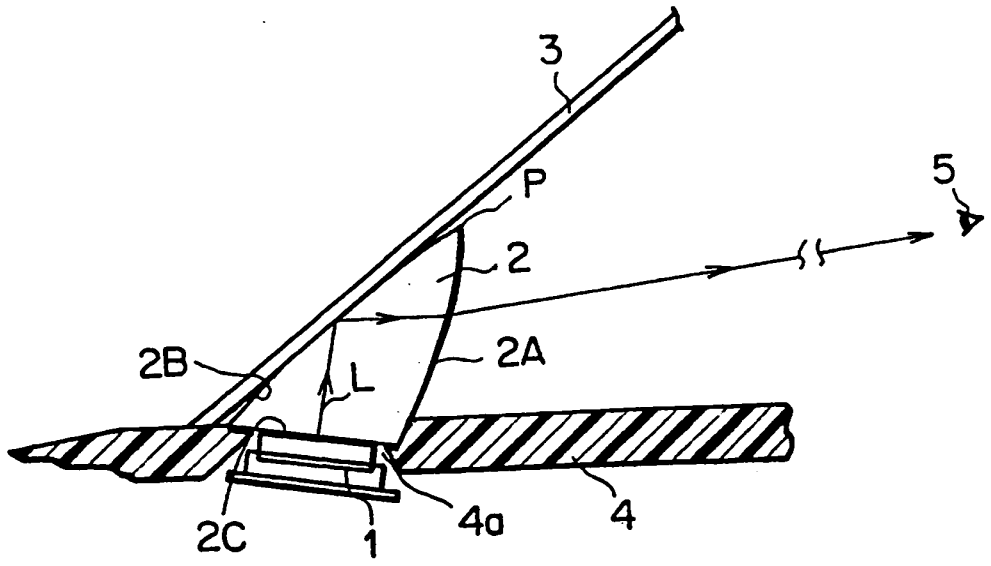


FIG. 3

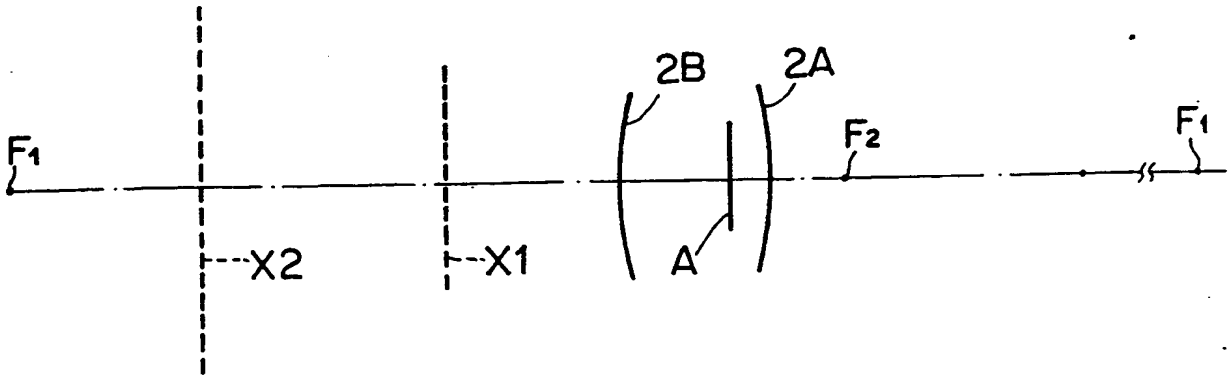


FIG. 4A

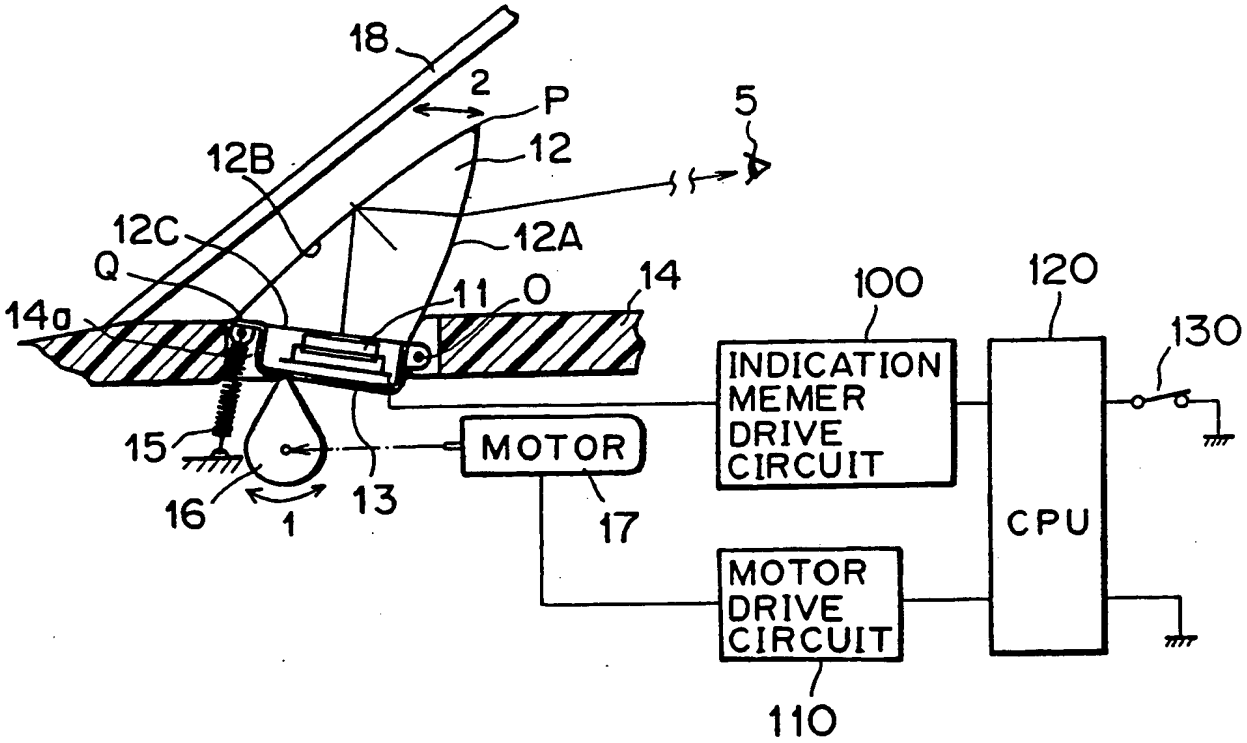


FIG. 4B

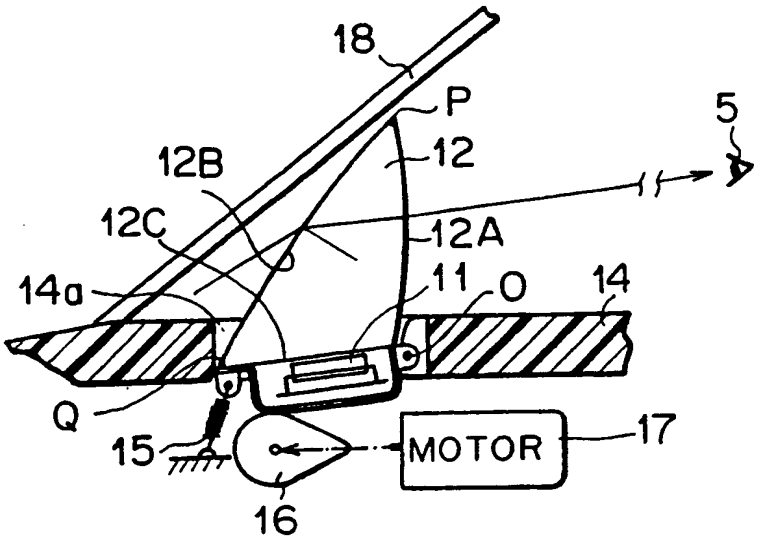


FIG. 5

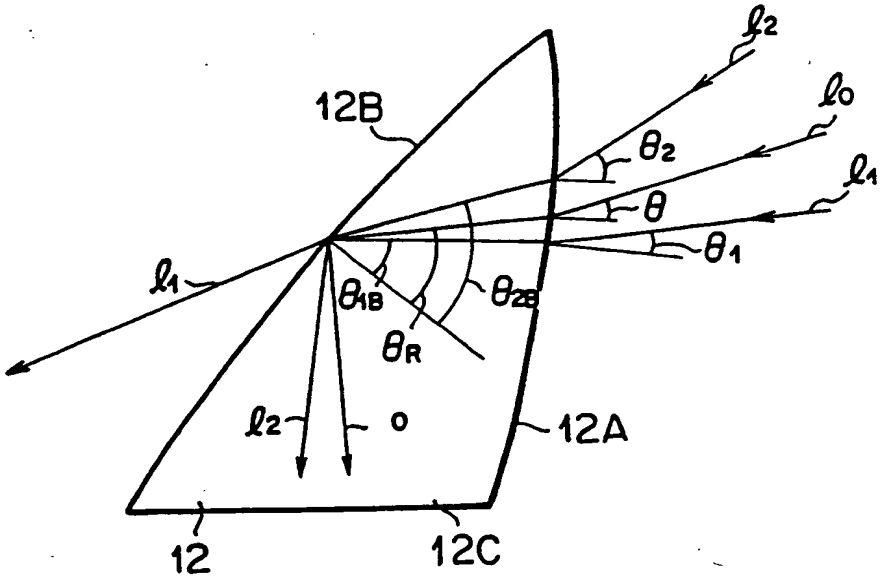


FIG. 6A

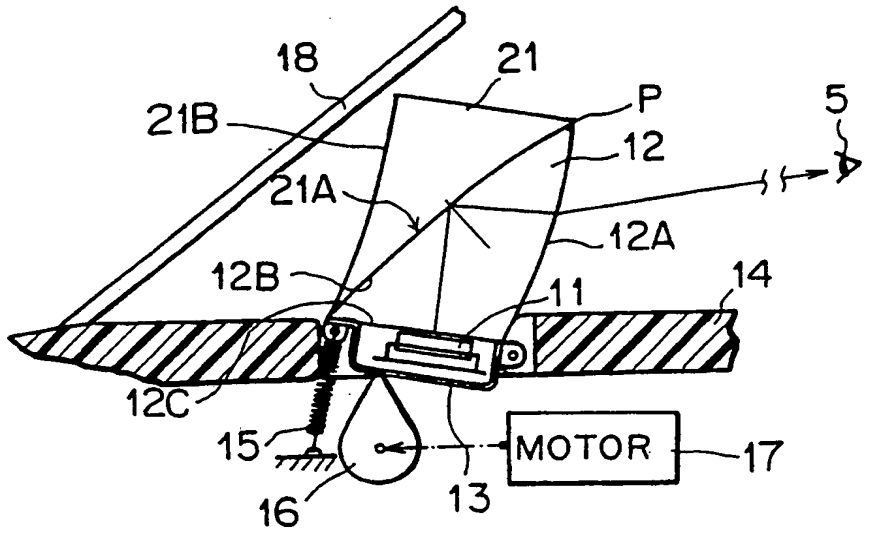


FIG. 6B

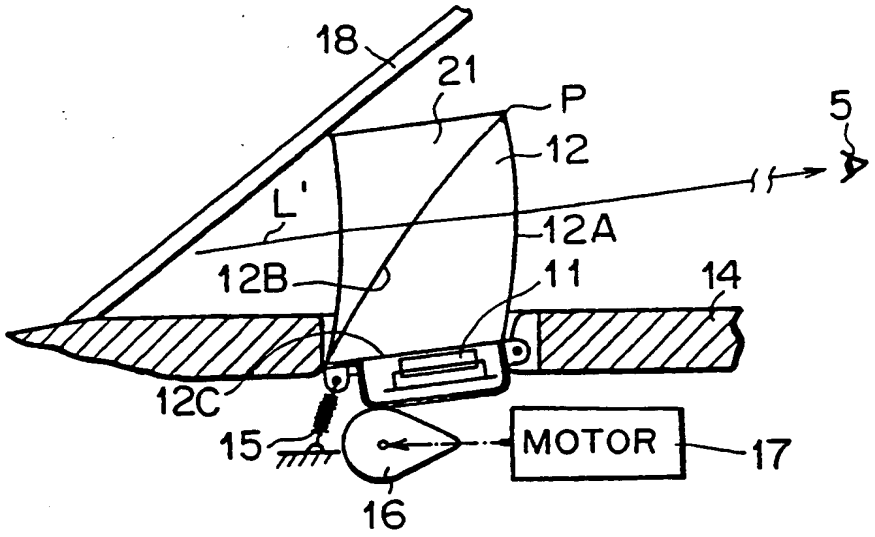
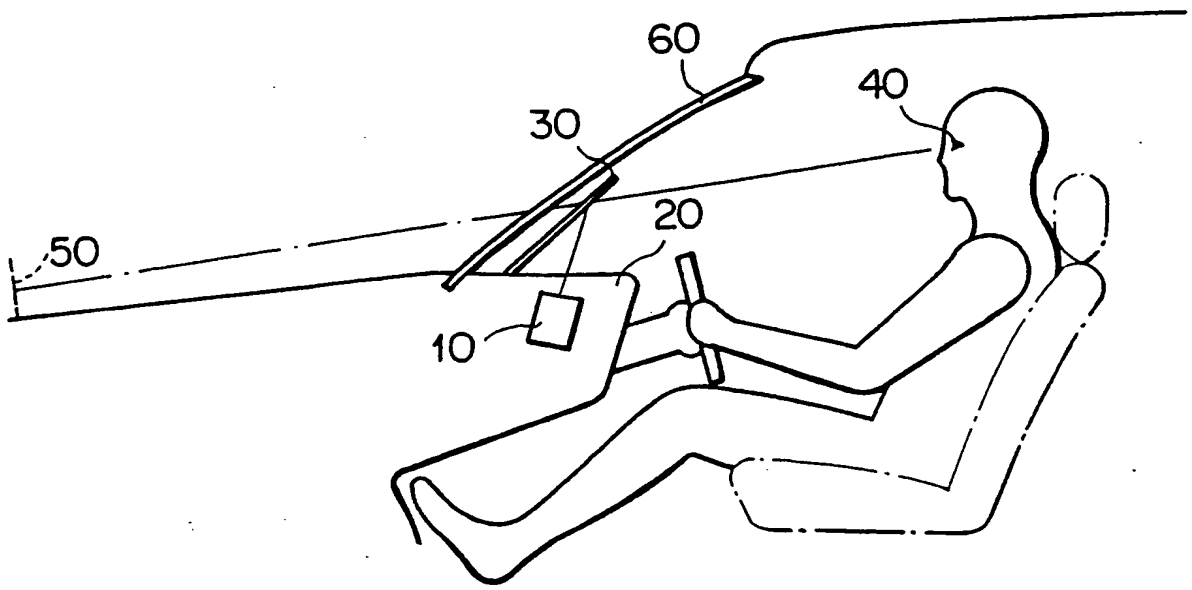


FIG. 7
PRIOR ART



TITLE OF THE INVENTION

Indication Display Unit for Vehicles

Indication Display Unit for Vehicles

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to an indication display unit for vehicles including indicators for indicating operational information such as vehicles speed, engine speed, residual fuel quality, time and other warnings, and also including a reflecting member having a reflecting surface on which indicated images by the indicators are reflected to allow the reflecting images to be visibly observed by a driver.

Description of the Prior Art

Conventionally, there have been proposed various indication display unit for vehicles, a case in point being the one shown in Fig. 7.

This type of indication display unit is called a head-up display unit, wherein a projector 10 with its indicating surface directed upwards for indicating various information such as vehicle speed and so on is disposed in the dash board 20, and the indicated image from the projector 10 is reflected on a half-mirror 30 which is disposed on the dash board 20, whereby the virtual image 50 thereof, which is superposed on the external front view seen through the windshield 60, can be visibly observed from a visual point 40 at the driver's seat.

By use of the head-up display device as constructed

above, the driver can observe the indicated image without turning his eyes toward various indicating meters, and an improved observability is thereby made possible.

By the way, since the driver can visibly observe the external front view through a half-mirror because there is no hindrance caused thereby to the driver's visual field with respect to the windshield, above conventional device is optimum for the head-up display type unit. However, the half-mirror is rather weak as itself or as a material to be constructed on the dash board which is supposed to be firmly fixed thereon, and accordingly it is not easy to maintain the reflecting surface thereof in a stable position, and in addition, since the indication light (or a light projected for indication) is reflected on two surfaces of the half-mirror; in the front and rear surfaces, there is a doubled image produced thereby, and the thus produced doubled image reflected on the half-mirror can be distinctly observed in some occasions, specially when the indicated image is substantially small, causing an inferior observability, and inferior quality of the indicated image itself.

By the way, even though the indicated image is not fully superposed on the external front view as is done in the conventional device, a substantially similar effect to that of the head-up display using a half-mirror can be obtained, on condition that the indicated image is observed

around the driver's visual field of the windshield, such as a nearby area of the upper surface of the dash board.

SUMMARY OF THE INVENTION

Considering the above described factor, it is an object of the present invention to provide an indication display unit for vehicles which enables a driver to visibly observe an indicated image near the driver's visual field of the windshield by reflecting the indicated image from the indicating member on a reflecting member mounted on the dash board, which reflecting member is other than a conventional type head-up display unit adopting a half-mirror and yet having a substantially same effect thereof, whereby a stably maintained reflecting surface, an improved observability and also an improved image quality are provided.

An indication display unit for vehicles according to the present invention provided to solve the above subjects comprises an indicating member for displaying vehicle operational information encased in the dash board; a prism mounted on the dash board in such a manner that a crest portion of the prism is directed upwards at which a first and a second faces thereof abutting with each other, the abutting faces being directed respectively toward the driver's seat and to the windshield, characterized in that an indication light from the indicating member enters the prism by way of a third face of the prism which is facing

the dash board, the indication light then reflected on the inner surface of the second face directed to the windshield so as finally to be visibly observed through the first face directed to the driver's seat.

In the indication display unit for vehicles according to the present invention, an indication light from the indicating member enters the prism by way of the third face thereof which is facing the dash board, and the thus entered indication light is reflected within the prism on the inner surface of the second face directed to the windshield, and then finally goes out of the prism to the driver's seat through the first face thereof which is directed toward the driver's seat. Accordingly, the driver sitting at the driver's seat can observe the operational information indicated by the indicating member in the visual field on the second face of the prism directed to the windshield by way of the first face thereof. By the way, since the prism is disposed on the dash board, the second face thereof is located around the visual field of the windshield, so that the operational information is visibly observed by the driver around his visual field of the windshield.

Further, since the prism has its crest portion directed upwards, it is stably disposed on the dash board due to the width of the third fac of the prism which is faced the dash board.

Still further, the indication light directed toward the driver's seat is reflected only once on the inner surface of the second face of the prism, there is no doubled image produced as discussed above.

Other objects and features of the invention will be more fully understood from the following detailed description and appended claims when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of one preferred embodiment of the indication display unit for vehicles according to the present invention;

Fig. 2 is a partially explodes sectional view of the first preferred embodiment as viewed in Fig. 2;

Fig. 3 is an illustration explaining how to magnify or put in a farther distance an indicated image;

Figs. 4A and 4B are respectively sectional views of the second preferred embodiment according to the present invention;

Fig. 5 is an illustration explaining the operation performed by a prism adopted in the second preferred embodiment;

Figs. 6A and 6B are respectively sectional views of a third preferred embodiment according to the present invention; and

Fig. 7 is an illustration showing an example of a conventionally used head-up displaying device.

DETAILED DESCRIPTION OF THE DRAWINGS

Fig. 1 is an illustration showing a first preferred embodiment of the indication display unit for vehicles according to the present invention, and Fig. 2 is a sectional view of the same embodiment. Referring to these figures, reference numeral 1 denotes an indicating member of a self-lighting type which indicates operational information such as vehicle speed and so on, reference numeral 2 denotes a prism formed of a transparent acrylic material, numeral 3 denotes a windshield, 4 a dash board and reference numeral 5 denotes a visual point at the driver's seat.

The indicating member 1 is encased in the dash board 4 near the low end of the windshield 3, with its indicating surface directed upwards by way of an open inlet 4a of the dash board 4. By the way, the indicating member 1 can be formed by a vacuum fluorescent tube (VFT), a light emitting diode (LED), back-light type liquid crystal display (LCD) or the like.

The prism 2 is disposed on the dash board 4 at the upper position of the indicating member 1 in such a manner that a crest portion P at which the first face 2A and the second face 2B are abutting to each other is directed upward, wherein the first face 2A is directed to the driver's seat and the second face 2B is abutted to the

inner surface of the windshield 3, the second face 2B being inclined towards the driver's seat. Further, the third face 2C of the prism 2 which is located facing the indicating member 1 is formed with a black coated layer, and this coated layer is formed only on the portion other than the indication pattern of the indicating member 1.

The indication light from the indicating member 1 enters the prism 2 through the third face 2C thereof, and the thus entered indication light is then reflected on the inner surface of the second face 2B toward the first face 2A side, and then transmits through the first face 2A toward the visual point 5 of the driver. Accordingly, the indicated image from the indicating member 1, which is reflected on the inner surface of the second face 2B of the prism 2, is observed within the visual field on the second face 2B by way of the first face 2A from the visual point 5 or the nearby area. By this phenomenon, the driver can observe operational information indicated by the indicating member 1 around the visual field of the windshield 3, so that a substantially similar effect to the head-up display unit can be obtained.

By the way, as shown in Fig. 2, the first face 2A and the second face 2B of the prism 2 are respectively formed in a convex shape, and due to this convex shape of the first face 2A and the second face 2B, the indicated image is magnified and positioned in the long distance.

Fig. 3 is an illustration explaining how the indicated image from the indicating member is magnified and positioned in the long distance, wherein a relationship among the indicating member 1, the second face 2B and the first face 2A of the prism 2 is depicted from the optical point of view.

The second face 2B is formed in a concave state with respect to the inside portion of the prism 2, and the indicating surface 1a of the indicating member 1 is located between the focal point F2 of the concave face and the second face 2B. By this construction, a virtual image X1 of the indicated image A indicated on the indicating surface 1a of the indicating member 1 is formed by way of reflection on the inner surface of the second face 2B and positioned in the long distance. On the other hand, the first face 2A functions as a concave lens with respect to the transmitted light, and is constructed such that the virtual image X1 formed by the second face 2B is located inside the focal point F1 of the concave lens formed by the first face 2A, and by this construction, the virtual image X1 is further magnified by the function of the concave lens, so that a virtual image X2 is formed at a farther distance than the position of the virtual image X1.

As shown above, the virtual image X2 which is magnified by the second face 2B and formed at a farther distance by the first face 2A can be finally observed from the visual

point 5 or the nearby area.

By the way, since the prism 2 is located near the low end of the windshield 3, the observable area from the driver's seat side (the area including the first face 2A thereof) is near the bonnet of the vehicle, the driver's visual field in the forwardly direction is not hindered thereby, yet the observable area is near the visual field of the windshield, so that a similar effect to the head-up display unit can also be obtained.

The prism 2 is supported by the dash board 4 around the third face 2C thereof due to the fact that its crest portion P is directed upwards, in other words, the prism 2 is held in a stable position in the forward and rearward directions with respect to the dash board 4 by the forward end and the rear end of an open inlet 4a of the dash board 4.

Figs. 4A and 4B are respectively sectional views of the second preferred embodiment according to the present invention. In the figure, although the indicating member 11 and the prism 12 are of the same construction as the indicating member 1 and the prism 2 of the first preferred embodiment, the indicating member 11 is encased in a case 13 in the second embodiment in such a state that it is directed against the third face 12C of the prism 12, and the prism 12 is fixed to the case 13.

The case 13 is disposed within the open inlet 14a of

the dash board 14, and the rearward portion of the case 13 is axially supported at the rotation fulcrum O of the end portion of the open inlet 14a, whereas the forwardly portion of the case 13 is biassed downwardly by a spring coil 15 one end of which is firmly fixed inside the dash board 14, and due to this biased force and the self-weight of the prism 12, the lower surface of the case 13 is abutted to the cam 16 which is disposed within the dash board 14.

The cam 16 is connected to a motor 17 by way of a toothed wheel not shown, so that when the motor 17 is activated, the cam 16 is rotated in the direction indicated by an arrow 1, in accordance with which the indicating member 11 and the prism 12 are rotated in the direction as shown by an arrow 2.

Referring to Fig. 4A, reference numeral 100 denotes an indicating member drive circuit for activating the indicating member 11, reference numeral 110 denotes a motor drive circuit for driving the motor 17, numeral 120 denotes a control unit composed of a micro-processor or the like, 130 denotes an operation switch to be operated by the driver, wherein the control unit 120 outputs indication data to be indicated by the indicating member 11 to the indicating memb r drive circuit 100 based on the signals received from various sensors such as a vehicle speed sensor (not shown) and so forth, and then the indicating

member drive circuit 100 displays a specified indication on the indicating member 11 in accordance with the thus obtained indication data.

By the way, the control unit 120 monitors the operating state of the operation switch 13, wherein when the operation switch 130 is set to "ON", it displays the indication on the indicating member 11, and also controls the activation of the motor 17 by way of the motor drive circuit 110 so as to put the prism and the indicating member 11 to the state as shown in Fig. 4A. On the other hand, when the operation switch 130 is set to "OFF", the control unit stops the indication on the indicating member 11, and at the same time controls the activation of the motor 17 so as to put the prism 12 and the indicating member 11 to the state as shown in Fig. 4B.

Fig. 5 is an illustration explaining the operation performed by the prism 12. Referring now to the figure, considering an incident light $\ell 0$ which enters from the driver's visual point or the nearby area into the prism 12, whose angle of incidence at the first face 12A of the prism is θ, and that at the second face 12B is a critical angle r, in the case of an indication light $\ell 1$ whose angle of incidence $\theta 1$ at the first face 12A is smaller than θ of the incident light $\ell 0$ will have its angle of incidence $\theta 1b$ at the second face 12B which is smaller than the critical angle θr, it transmits through the second face 12B to the

windshield 18 side. On the other hand, in the case of an incident light $\ell 2$ whose angle of incidence $\theta 2$ at the first face 12A is larger than ℓ of the incident light $\ell 0$ will have its angle of incidence $\theta 2b$ at the second face 12B which is larger than the critical angle θr, it is totally reflected to the third face 12C side of the prism 12.

By the way, the rotated position of the prism shown in Fig. 4A is predetermined such that the angle of incidence at the low end Q of the second face 12B is larger than the critical angle θr with respect to the incident light entered from the driver's visual point or the nearby area. Further, the rotated position of the prism 12 shown in Fig. 4B is predetermined such that the angle of incidence at the crest portion P is smaller than that of the critical angle θr with respect to the incident light entered from the driver's visual point or the nearby area.

Accordingly, as we can see by tracking the incident light explained in Fig. 5 the other way round, in the case of Fig. 4A, the second face 12B becomes a total reflecting surface, and thereby the third surface 12C and the indicating member 11 can be observed, and in the case of Fig. 4B, the prism 12 itself can be observed as a transparent body.

As explained above, since the prism 12 can be switched to a total reflecting surface or to a transparent body in accordance with the rotated location thereof, when the

operation switch 130 is set to "ON" so as to display the operational information on the indicating member 11 as shown above, the indicated image can be visibly observed by way of the second face 12B with a dark color of the third face 12C as its back view. On the other hand, when the operation switch 130 is set to "OFF", and no display of indication is required, the prism 12 becomes a transparent body. Accordingly, the second face 12B, which can be a reflecting surface for indication, will not be a hindrance to the driver even when no display of indication is required.

Further, since the first face 12A and the second face 12B of the prism 12 of the second embodiment are respectively formed in convex surfaces, the indicated image is magnified and positioned in the long distance as in the case of the first embodiment. Further, since the prism 12 is disposed on the dash board, that is, in the lower portion of the visual field in which the windshield 18 is sighted from the driver's seat, the same head-up display effect as the first embodiment can be obtained as well.

Figs. 6A and 6B are respectively sectional views of the indication display unit for vehicles according to the third embodiment of the present invention, wherein a corrective prism is added to the prism 12 of the second embodiment, and the location of the open inlet 4a of the dash board 14 is thereby shifted away from the windshield 18 for the size

of this additional prism 21.

The corrective prism 21 contains a concave surface 21A which is adjusted with the second face 12B of the prism 12, and a concave surface 21B which has substantially the same surface with the convex surface 12A of the prism 12, wherein the concave surface 21A and the concave surface 21B are abutted to each other, and the concave surface 21A is closely attached to the second face 12B of the prism 12.

In the state as shown in Fig. 6A, the indication of the indicating member 11 can be observed on the second face 12B of the prism 12 as the case of the second embodiment shown in Fig. 4A, and in the sate as shown in Fig. 6B, regarding the light L' which transmits through the corrective prism 21 and the prism 12, the light enters and that goes out are substantially in parallel, so that the effect caused by refraction is substantially low compared with the case of the second embodiment, and accordingly the hindrance to the visibility is further eliminated due to the fact that these prisms are observed as transparent.

By the way, although the prism 12 used in the second embodiment and the third embodiment are firmly encased in the case 13 respectively, since the prism 12 is fixed in such a manner that the crest portion P thereof is directed upwards and the third face 12C thereof is facing the case 13 side, the rear end portion of the case 13 and the operating point abutted to the cam 16 at the forwardly

portion of the surface of the case 13 can be disposed with a certain distance therebetween, whereby even when it is rotated by the cam 16, the rotated position can be precisely maintained, and accordingly the prism 12 is maintained in a stable state with respect to the dash board 14. In addition, as shown in each of the embodiments, since the indicated image observed at the driver's seat is the image reflected only once on the inner surface of the second face, no doubled image can be produced thereby.

By the way, in a conventional device explained in Fig. 7, although an optical system such as a lens and so on is encased in the projector 10, and a virtual image 50 is thereby magnified in the long distance, the indicated image in the respective embodiments according to the present invention can be magnified and positioned in the long distance by making the first and second faces of the prism in a convex shape, whereby the optical system and the reflecting surface are integrally formed and therefore number of required parts is reduced as well. In this occasion, even if only one of these first and second faces is formed in a convex shape, the indicated image can still be magnified and positioned in the long distance.

[Effect of the Invention]

As explained heretofore, since the indication display unit for vehicles according to the present invention

comprises a prism as a reflecting surface for reflecting the indication light from the indicating member, and the prism is disposed on the dash board in such a manner that a crest portion of the prism is directed upwards at which a first and a second faces thereof abutting to each other, the two abutting faces being directed respectively to the driver's seat and to the windshield, wherein an indication light from the indicating member enters the prism by way of a third face of the prism which is facing the dash board, and the entered indication light is then reflected on the inner surface of the second face directed to the windshield so as to allow operational information to be visibly observed through the first face, the indicated image can be observed around the visual field of the windshield, and yet no doubled image is caused due to the fact that the indicated image is reflected only once on the inner surface of the second face of the prism, and further, the reflecting surface is stably disposed on the dash board due to the width of the third face thereof facing to the dash board. By all these factors, an indication display unit for vehicles which provides a stably mounted reflecting surface, improved observability and improved quality of the indicated image can be obtained.

In addition, according to each of the above embodiments, since an optical system and a prism is integrally formed by making the prism comprising convex

surfaces, number of required parts is reduced, and yet magnified indicated image can be thereby observed in the long distance.

While the invention has been described with reference to specific embodiments, the description is illustrative and is not to be construed as limiting the scope of the invention. Various modifications and changes may occur to those skilled in the art without departing from the spirit and scope of the invention as defined by the appended claims.

CLAIMS

1. A display unit for vehicles comprising:

an indicating means, for displaying vehicle operational information, disposed in a housing locat d within a vehicle dashboard, the housing being abutted to a cam disposed thereunder;

a prism having at least three faces and mounted on the dashboard in such a manner that a crest portion, formed between adjacent first and second faces thereof, is directed upwards, the first and second faces being directed respectively towards the driver's seat and towards the windshield, and the third face being firmly attached to the housing such that the indication surface of the indicating means is directed upward, wherein an indicated image projected from the indicating means enters said prism by way of said third face thereof, and is reflected on the inner surface of said second face so as finally to be visibly observed through said first face.

2. A display unit as claimed in claim 1, wherein the rearward portion of the housing is axially supported and the forward portion thereof is downwardly biassed, whereby said prism is rotated by way of the movement of the housing which is activated by the rotating movement of said cam.

3. A display unit as claimed in claim 3, which further comprises a corrective prism which contains a concave surface against the second face and a concave surface which has substantially the same shaped surface as the first face.

4. A display unit for vehicles comprising:

an indicating means, for displaying vehicle operational information, disposed in a vehicle dashboard;

a prism having at least three faces mounted on said dashboard in such a manner that a crest portion, formed between adjacent first and second faces thereof, is directed upwards, the first and second faces being directed respectively towards the driver's seat and towards the windshield, and said third face facing said dashboard, wherein an indicated image projected from said indicating means enters said prism by way of said third face thereof, said indicated image being reflected on the inner surface of said second face so as finally to be visible observed through said first face.

5. A display unit as claimed in claim 4, wherein said second face of said prism is abutted to the windshield.

6. A display unit as claimed in claim 4 or claim 5, wherein at least one of said first and second faces is formed in a convex shape.

7. A display unit as claimed in claim 6, wherein, in the case that said second face is formed in a convex shape, the indicating surface of said indicating means is located within the focal plane of the second face of said prism, and in the case that said first face is formed in a convex shape, said indicated image reflected on the inner surface of said second face is located within the focal plane of said first face of said prism.

8. A display unit for a vehicle, substantially as described with reference to any of the examples shown in Figures 1 to 6 of the accompanying drawings.

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